AIR BLOWER

TECHNICAL FIELD

The present invention relates generally to an air blower including a sirocco-fan, turbo blower and the like.

BACKGROUND ART

The conventional air blower supports rotatably the shaft of the impeller via the ball bearing, sleeve bearing, bearing, oil retaining bearing.

It does not allow the air blower with such bearing to rotate at high speed so that it is difficult to downsize and it has a short life span because it needs certain large size of the impeller.

In addition, for the air blower which is attached an impeller to a motor with a core, eddy-current loss and hysteresis loss of the core become large as it rotates on high speed.

Accordingly, it is an object of the present invention to provide an air blower which can rotate at a high speed, blow in under high pressure at large air volume even though it is small size and is economical and long-lived.

In addition, it is another object of the present invention to provide an air blower which can control to move an impeller to a thrust direction extremely with blowing and protect an impeller to hit a case body. Also it is still another object of the present invention to provide an air blower which can reduce oscillation and noise.

The present invention is understood to encompass embodiments which include all or only a portion of the above objects, features and advantages which, unless recited in claims defining the invention, are understood not to limit interpretation of such claims. The above, and other objects, features and advantages of the present invention will become apparent from the following description read in conjunction with the accompanying drawings, in which like reference numerals designate the same elements.

It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention.

SUMMARY OF THE INVENTION

Accordingly, the air blower includes a case body having an air suction mouth formed at least one side surface thereof and an outlet formed at a peripheral wall thereof; a motor which is installed into the case body, having a fluid dynamic bearing; and an impeller which is fixed to a rotation member of the motor in order to locate at an outer circumferential part of the motor, suctioning air from the air suction mouth by rotating and discharging from the outlet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view showing a first embodiment of the present invention;

FIG. 2 is a front view showing a first embodiment of the present invention;

FIG. 3 is a bottom view showing a first embodiment of the present invention;

FIG. 4 is a plan view showing the way in which a covering case is removed;

FIG. 5 is a cross sectional view taken along a line 5-5 in FIG. 1;

FIG. 6 is a cross sectional view of a motor showing a first embodiment of the present invention;

FIG. 7 is an explanation of an impeller showing a first embodiment of the present invention;

FIG. 8 is a plan view showing a second embodiment of the present invention;

FIG. 9 is a bottom view showing a second embodiment of the present invention;

FIG. 10 is a cross sectional view taken along a line 10-10 in FIG. 8;

FIG. 11 is a plan view showing a third embodiment of the present invention;

FIG. 12 is a bottom view showing a third embodiment of the present invention;

FIG. 13 is a cross sectional view taken along a line 13-13 in FIG. 11;

FIG. 14 is a plan view showing a fourth embodiment of the present invention;

FIG. 15 is a bottom view showing a fourth embodiment of the present invention;

FIG. 16 is a cross sectional view of a motor showing a fourth embodiment of the present invention;

FIG. 17 is a perspective view showing a fifth embodiment of the present invention;

FIG. 18 is an exploded perspective view showing a fifth embodiment of the present invention;

FIG. 19 is a cross sectional view taken along a line 19-19 in FIG. 17; and

FIG. 20 is a cross sectional view taken along a line 20-20 in FIG. 17.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Preferred embodiments of the present invention are described in more detail below referring to the accompanying drawings.

An understanding of the present invention may be best gained by reference FIGS. 1 to 7.

The reference numeral 1 is an air blower of the present invention which is comprised of a case body 6 having an air suction mouth 3 formed at one side surface 2 thereof and an outlet 5 formed at a peripheral wall 4 thereof; a motor 7 which is installed into the case body 6, having a fluid dynamic bearing which is driven at a high speed; and an impeller which is fixed to a rotation member of the motor so as to locate at an outer circumferential part of the motor 7, suctioning air from the air suction mouth 3 by rotating and discharging from the outlet 5.

The case body 6 has attachment parts 11, 11 having an insertion hole 10, which is screwed by a screw 9, formed at the outer circumferential part of the case body 6 and is comprised of a case member 12 which is formed a part of the outlet 5; and a covering case 15 which is formed some portions of the air suction mouth 3 and outlet 5, having engaged holes 14, 14 and 14 which is capable of attaching detachably to a plurality of engaging pieces 13, 13 and 13 of the case member 12.

The motor 7 is further comprised of a base plate 17 which is fixed to an inner bottom surface of the case member 12 of the case body 6, being provided a motor drive circuit (not shown); a shaft 18 which is fixed so as to project upward from the base plate 17; a sleeve 20 which is arranged at an outer circumferential part of the shaft 18 via a minute space 19; a rotor 21 which is provided at an outer

circumferential part of the sleeve 20, arranging permanent magnets; a coreless waveform continuation coil 22 which is attached to the base plate 17 so as to positioned around an outer circumferential part of the rotor 21; a back yoke 23 which is provided so as to position around an outer circumferential part of the coil 22; a thrust magnet 26, which is formed in the shape of a ring, fixed to a concave part 25 which is formed at the upper part of the hub 24 which covers the shaft 18, supporting the sleeve 20, rotor 21 and back yoke 23, having a hub 24 as the rotation member 24 which covers an upper part of the shaft and the outer circumferential part of the back yoke 23; and a thrust magnet 27 which is fixed to the upper part of he shaft 18 so as to face to the thrust magnet 26.

The impeller 8 is further comprised of an impeller body 28, which is formed in the shape of a disc, fixing with engagement to the outer circumferential part of the hub 24 as the rotation member of the motor 7; a plurality of blades 29, 29 which are formed integrally at the outer circumferential part of the impeller body 28 at a constant intervals so as to project outwardly; and a plurality of holes 30, as means for protecting contact, forming a part except for the part which is formed the blades 29, 29 of the impeller body 28 at a constant intervals, blocking the excessive movement of the impeller 8 to a thrust direction in a condition that the pressure in the both sides of the impeller body 28.

For the air blower 1, the impeller 8 rotates at a high speed after the motor 7 is driven. Then, air is sucked from the air suction mouth 3 of the case body 6 and is discharged from the outlet 5. Therefore, it can blow in under high pressure at large air volume even though it has small size.

Since the motor 7 has the rotor 21 which is arranged the permanent magnet with revolving structure around the outer circumferential part of the sleeve 20 which is positioned surrounding the outer circumferential part of the shaft 18 via minute space 19 and the coreless waveform continuation coil 22, there is absolutely no harmful power which is added to the shaft 18 and sleeve 20 from the magnetic circuit generating the revolving force.

For this reason, it takes bearing rigidity to just support empty weight of the rotor 21 basically.

In addition, even through the impeller 8 rotates at high speed, the pressure in the both sides of the impeller body 28 is identical with approximately by the holes 30 as means for protecting contact, and it

can block to move the impeller 8 to a thrust direction excessively.

In this way, the motor 7 with the fluid dynamic bearing is used in the present invention so that it can blow in under high pressure at large air volume even though it has small size and is economical and long-lived. In addition, it can control to move an impeller to a thrust direction extremely with blowing and protect an impeller to hit a case body.

In addition, it can reduce eddy-current loss and hysteresis loss because the motor is used the coreless motor type.

Other embodiments of the present invention will now be described referring to FIGS. 8 to 20. Through the drawings of the embodiments, like components are denoted by like numerals as of the first embodiment and will not be further explained in great detail.

A second embodiment of the present invention is shown in FIGS. 8 to 10 and is distinguished from the first embodiment by the fact that the case body is replaced from another case body 6A having an air suction grooves 31, 31, which is formed in the shape of an arc, which is formed at the case member 12; and the motor 7 is replaced from another motor 7A having the back yoke 23 which is fixed to the base plate 17. An air blower 1A in this way according to the third embodiment has similar advantages to that according to the first embodiment.

A third embodiment of the present invention is shown in FIGS. 11 to 13 and is distinguished from the first embodiment by the fact that the impeller is replaced from a sirocco-fan 32 which is formed a flange 33 at a lower part thereof, the blades forming at the flange 33; and the holes 30, as means for protecting contact, are formed at the flange 33 of the sirocco-fan 32. An air blower 1B with sirocco-fan 32 according to the third embodiment has similar advantages to that according to the first embodiment.

In addition, in this embodiment, it may be installed means for protecting contact, being arranged magnet with the same magnetic pole which bias an upper end part of the sirocco-fan 32 and inner wall surface of the case body 6A facing to the upper end part thereof.

A fourth embodiment of the present invention is shown in FIGS. 14 to 16 and is distinguished

from the first embodiment by the fact that the shaft 18 is replaced from another shaft 18A having dynamical-pressure grooves 34, 35 of right and left leads having 3 micron in groove depth, 30 degrees in lead angle, 0.5 mm in groove width, 1 mm in pitch; the impeller 8 is replaced from another impeller 8A which does not have holes; a magnet 46 is fixed to the upper part of the outer circumferential part of the hub 24; and means 30A for protecting contact has a magnet 47, biasing the magnet 46, which is fixed to the inner wall surface, corresponding to the magnet 46, of the covering case 15 of the case body 6. An air blower 1C according to the fourth embodiment has similar advantages to that according to the first embodiment.

In addition, the protecting means 30A may be blocked the contact based on the generated thrust dynamical pressure by rotating the hub 24 in a case that the spiral groove is formed at the upper part of the outer circumferential part of the hub 24.

Furthermore, when the biasing magnets 46, 47 are attached to the upper surface of the center part of the shaft 18A and the center part of the concave part 25 of the upper part of the hub 24 respectively, it can control to move in the thrust direction.

A fifth embodiment of the present invention is shown in FIGS. 17 to 20 and is distinguished from the first embodiment by the fact that the case member 12 is replaced from another member 12A which includes an impeller storage room 36, the air suction mouth 3, a first air chamber 37 which connects to the air suction mouth 3 and a second air chamber 39 which connects to the first air chamber 37 via a through hole 38; the case body 6 is replaced from another case body 6B which includes a partition wall 42 having a second through hole 40 which connects to the second air chamber 39 covers an opening part 12a of the case member 12A and a third through hole 41 which connects to the impeller storage room 36 and a covering case 15A, which is formed in the shape of a shallow cover, having an air channel 44 which introduces the air to the third through hole 41 after it passes the outer circumferential part of a partition plate 43 from the second through hole 40, forming the partition plate 43, which is formed is the shape of a question mark without dot, being located inside the covering case 15A which covers the upper part of the partition wall 42; and an intake silence channel 45 including

the first air chamber 37, the through hole 38, the second air chamber 39, the second through hole 40, the air channel 44 and the third through hole 41 which passes the air which is sucked from the air suction mouth 3. An air blower 1D with the case body 6B having the intake silence channel 45 according to the fifth embodiment has similar advantages to that according to the first embodiment and it can reduce the suction sound.

In addition, the intake silence channels 45, including the first air chamber 37, through hole 38, second air chamber 39, second through hole 40, air channel 44 and third through hole 41, which are formed at the case body are explained in this embodiment. In addition, at least one silence room may be formed.

In the first embodiment and second embodiment of the present invention, the impeller 8 with the holes 30 as means of preventing the contact is explained. In addition, in this invention, the ring-shaped thrust magnet 26 of the motor 7 and the magnet of the thrust magnet 27 which is fixed to the upper part of the shaft 18 may block the extreme movement to the thrust direction, and the magnet may be formed, the magnet generating the sucking force to pull back with the movement to the thrust direction.

In addition, the coreless waveform continuation coil 22 as the coil is explained in each embodiment in the present invention. Additionally, the coils other than the coreless waveform continuation coil may be used.

Additionally, when the impeller is formed of the plastic magnet, and the blocking means, controlling the rotor magnet and movement to the thrust direction is attached to the impeller, the number of the assemble member may be reduced, and the manufacturing process may be simplified and the like.

As set forth above, the advantages of the invention are as follows:

(1) The air blower includes a case body having an air suction mouth formed at least one side surface thereof and an outlet formed at a peripheral wall thereof; a motor which is installed into the case body, having a fluid dynamic bearing; and an impeller which is fixed to a rotation member of the motor in order to locate at an outer circumferential part of the motor, suctioning air from the air suction

mouth by rotating and discharging from the outlet so that the impeller can be rotated by the motor with the fluid dynamic bearing.

Therefore, since the noncontact fluid dynamic bearing supports rotatably the impeller without the contacted bearing including the conventional ball bearing, sleeve bearing and oil retaining bearing, it can rotate at a high speed and blow in under high pressure at large air volume even though it is small size.

(2) As discussed above, since it can be prevented the contact resistance and wear during rotating, it can be economical and long-lived.

(3) The coreless motor as the motor as discussed above is used so that it can reduce eddy-current loss and hysteresis loss.

(4) Also claim 2 has the same effect as the above (1) to (3), and the contact-block means can prevent the trouble that the impeller moves to the thrust direction extremely and hit the case body.

(5) Also claim 3 has the same effect as the above (1) to (3), and it can reduce the suction sound by at least one silence room of the intake silence channel.

(6) Also claim 4 has the same effect as the above (4) and (5).

INDUSTRIAL APPLICABILITY

The present invention is utilized in industry for the air blower.